

**FLUORESCENT LAMP
STEWARDSHIP INITIATIVE**

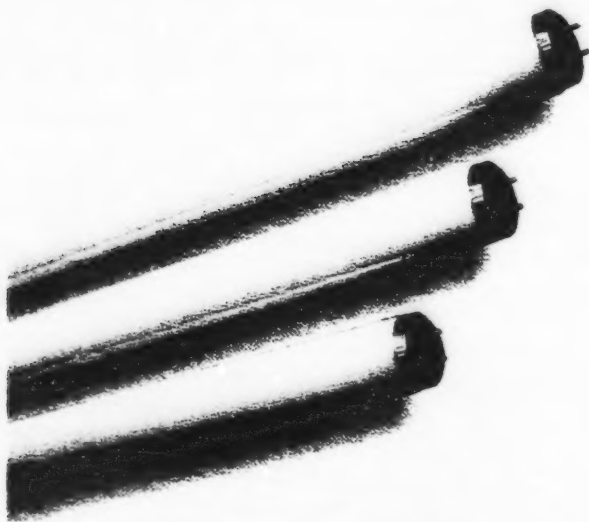


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1.0 BACKGROUND

Close to six million fluorescent and high intensity discharge (HID) lamps, containing mercury, are disposed of in Alberta every year. With each lamp containing on average 15 milligrams of mercury there is a reservoir of mercury in the province's waste stream of close to 87.5 kilograms. While this may seem like a small amount, its release into the environment is of great concern.

Sometimes known as quick silver, mercury is a naturally occurring element that has a well-documented toxic effect on the human body. Symptoms of mercury poisoning range from loss of feelings in the limbs, tunnel vision, personality changes and coma. The condition was once commonplace amongst hatters, who used mercuric nitrate to soften felt and gave rise to the expression "Mad as a Hatter". Like water, mercury can evaporate. Once released into the environment, it can circulate in the atmosphere for numerous years and travel great distances before it ultimately settles on land, lakes and oceans. Bacteria and chemical reactions in aquatic environments change mercury into a much more toxic form known as methyl mercury. This neuro-toxin, once in the food chain, can cause irreversible environmental damage.

Fluorescent lamps are currently the most efficient and cost effective source of lighting today. They require less energy than filament bulbs and in newer product applications are known to reduce lighting costs by 30%. Manufacturers have been successful in reducing mercury content in lighting products and, while the mercury content in some products has been reduced to 10 mgs. and less (T8 lamps); and while product development research is aimed at even further reductions, mercury free fluorescent lighting in the short term (10 years) is unlikely.

Until a suitable replacement is found for mercury, the only sensible solution is to keep use to a minimum and ensure for safe disposal and/or recycling of fluorescents and HID bulbs. Landfill banning of these products has already occurred in Germany, Holland, Ireland and the Scandinavian countries. New legislation is emerging in the U.K. and the United States Environmental Protection Agency announced new rulings in July of 1999 that classified discarded fluorescent lamps as a universal waste and effectively banning mass dumping of fluorescent light bulbs into landfills. This ruling has encouraged recycling across the United States where it is estimated that there is in excess of 620 million lamps disposed each year (Environmental Impact Analysis: Spent Mercury Containing Lamps, NEMA, January 2000).

In Canada, the Canadian Council of Ministers of the Environment (CCME) are poised to adopt mercury emission standards that would apply to: metal smelting, waste incineration and coal fired electrical generation. They will also set standards for the development, use and handling of products that contain mercury including: sewage sludge, dental amalgam and fluorescent bulbs (see Appendix B). These standards are being developed under the Harmonization Accord and the "Canada-wide Standards Sub-Agreement". They are expected to be announced in November 2000.

In response to the ongoing efforts of the CCME to promote reductions in nation-wide mercury emissions, Alberta Environment and the Capital Region Waste Minimization Advisory Committee is working in partnership to encourage industry to set up a voluntary fluorescent lamp recycling program for Alberta.

It is believed that through awareness education, appropriate disposal and recycling, a standard that results in virtually no releases of mercury from these products is possible.

2.0 ALBERTA'S CURRENT SITUATION

2.1 Volume . . . What is the magnitude of the problem?

The combined impacts of mercury contamination are difficult to quantify because it is a natural and persistent bio-accumulative element that can be transported many miles in the atmosphere and sustained over many years. However, some research has been done to quantify sources of mercury and potential releases.

In Canada today, it has been estimated that mercury emissions are in the order of 12T / year (Canada Wide Standards for mercury containing products – Draft 4, April 7, 2000). While the major sources of emission (base metal smelting, waste incineration and coal fired electrical generation) contribute close to 5T / year of this amount, products containing mercury account for the remainder.

Appendix A provides a breakdown of mercury containing products and the estimates for emissions (releases) on a Canada wide basis.

Table 2.1.a is derived from Canada wide estimates and provides a breakdown of the estimated amount of mercury contained within products that enter Alberta's waste stream on an annual basis.

Table 2.1.a Annual Estimates of Mercury From Products in Alberta's Waste Stream

Product	Amount of mercury contained within products that enter the waste stream	
Sewage Sludge	1310 kg	Taken @ 10% of National estimates
Dental Amalgam	100 kg	C.C.M.E. research
Fluorescent Lamps	87.5 kg	Estimate identified in this study
Thermostats	90.0 kg	Taken @ 10% of National estimates
Batteries	145 kg	Taken @ 10% of National estimates
Electrical Switches & gauges	772 kg	Taken @ 10% of National estimates
Hospital equipment	29 kg	Taken @ 10% of National estimates
Thermometers	184 kg	Taken @ 10% of National estimates
Total in waste stream		3177.5 kg (3.1 Tonnes)

While the estimated annual amount of mercury contained within waste stream products is significant, some are more apt to enter the environment than others. For example, products like thermostats, batteries, electrical switches and thermometers have the mercury either well encapsulated within the product or there are programs of recovery in place (e.g. batteries). As a result, landfilling practices tend not to release the mercury content.

Sewage sludge that comprises the largest reservoir of mercury, is the subject of ongoing study and is pertinent to the treatment of heavy metals.

Dental amalgam, which contains approximately 50% mercury, is also targeted by the C.C.M.E. for program development. Approximately 1.5 to 2 tonnes per year of amalgam waste is generated in Canada each year from removal of old fillings and polishing new fillings (estimated 200 kg in Alberta). One hundred kg is mercury dust that can enter sewer systems and/or enter landfills if not properly disposed of.

Mercury from fluorescent bulb waste is highly susceptible to release because of the fragile nature of the product. Bulbs that are not recycled are most often broken in dumpsters or at the landfill, both emitting mercury vapor into the atmosphere and through leaching of mercury that is contained within the glass coated phosphor.

In Alberta last year major lamp manufacturers were reported by Stats Canada to have shipped 5.95 million bulbs or roughly 10% of the total Canadian shipments reported. These bulbs were retailed in the market place to replace old bulbs, which contained close to 90 kilograms of mercury. In Alberta, some building managers and lighting contractors follow a normal practice of 1/3 turnover per year in replacing bulbs. Others tend to replace bulbs as they burn out.

By applying a factor of 40 four-foot lamps per 1000 sq. ft. as an average lighting requirement, the total volume of bulbs in use, in Alberta, on an annual basis was calculated along with the estimated annual waste. (Table 2.1.b). Annual waste was calculated on the basis of replacement every three years, or one third of the total in use.

**Table 2.1.b Estimates of Elemental Mercury Contained in Alberta's
Fluorescent Bulb Waste Stream, 2000**

Sector	Estimate of sq footage (Million)	Estimate of bulbs in use ¹ (Million)	Estimate of annual waste ² (Million)	Mercury flux (amt in waste stream) ³ (Kilograms)
Office / Retail / Industrial (inc. municipal bldgs)	293	11.7	3.86	57.9
Alberta Gov't owned bldgs	22	.88	.29	4.3
Hospital & Health Care	26.9	1.0	.33	4.9
Colleges / Universities	35.8	1.4	.46	6.9
Public / Separate School System	70.1	2.85	.9	13.5
Totals	447.8	17.8	5.8	87.5

- 1 Estimates of bulbs in use represent an average of 40 four-foot fluorescent bulbs per 1000 sq. ft. The household market is excluded.
- 2 Annual bulb waste is calculated on the basis of three year life expectancy per bulb and coincides with common replacement programs that reflect changing 1/3 of total bulbs per year.
- 3 Mercury content is taken at an average of 15 mgs of mercury per bulb. It should be noted that this reflects the success of lighting manufacturers to reduce mercury content in bulbs from an average of 21 mgs to less than 10 mgs in some of the newer products (Osram – Sylvania). While the total reservoir of mercury from bulbs in use at present may be greater due to older products, the change over to more efficient, lower mercury products is rapidly progressing.

The estimates provided within the table closely confirm the volume estimates (5.95 million) that were shipped by manufacturers in Alberta in 1999.

Alberta's annual waste stream volume of fluorescent tubes is estimated at close to 6 million representing a mercury content of approximately 87.5 kilograms. This amount represents a reservoir from which potential environmental release can occur.

2.2 Current Recycling Efforts in Alberta

Of the six million fluorescent bulbs contained within Alberta's annual waste stream, it is estimated that 150,000 are currently recycled. This is a recycle rate of 2.5% (Table 2.2).

Table 2.2 Estimate of Fluorescent Bulbs Recycled in Alberta 1999

Collection Source	Volume (Bulbs)	Shipped outside Alberta	Recycled in Alberta
City of Edmonton Buildings and Facilities Maintenance Program	36,000	35,000	
Edmonton Eco Stations	3,500	3,500	
Private collection program			
inc. local recycling contractors that use portable equipment and/or collect on behalf of out-of-province recyclers	72,500	63,500	9,000
inc. local agencies and businesses that have purchased portable equipment (SAIT, AMOCO, Alberta Infrastructure in Calgary, etc.)	38,000		38,000
Totals	150,000	103,000	47,000

At present, there is only one Alberta based commercial fluorescent bulb recycler operating within the province (Environmental Lamp Disposal Ltd.). This recycler is currently re-establishing an operation in Edmonton and uses smaller scale, drum type lamp recycling technology ('lamp cracker'). Recycling contracts are established with building managers to either recycle on-site, when bulb replacement programs are under way, or to collect volumes at locations throughout Alberta for a pick up fee and return to the warehouse where volume crushing takes place.

Wastco Environmental Services Limited (CEDA) are distributors of the "Bulb Eater", a line of portable bulb crushing units that are being marketed and sold to larger businesses, institutions and agencies across Canada. Alberta Infrastructure (Remand Center in Calgary), S.A.I.T. and Amoco are amongst the list of clients who have purchased equipment and are developing their own, on-site bulb recycling programs with their on-site building maintenance staff.

Contact has been made with an individual in Calgary who has plans on building a larger scale bulb recycling plant. This plant would compare with larger Canada wide bulb recyclers in Aldergrove BC (NuLife) and Cambridge ON (F.L.R.), who now share in recycling 66% (103,000 bulbs) of the bulbs that were diverted from Alberta's landfills last year. The City of Edmonton currently maintains a lighting replacement contract (Osram-Sylvania) that specifies that bulbs will be safely recycled. The contractor sends these bulbs to NuLife at a rate of about 36,000 bulbs per year. An additional 3,500 bulbs are collected from Edmonton's Eco Centers each year and are also sent to NuLife for recycling.

Although recycle volumes are currently very low across Alberta, it would appear that some public agencies, institutions and businesses have exercised environmental stewardship and, while the cost to recycle will be a deterrent for some, a gradual increase in participation is likely to occur in line with heightened awareness and convenient recycling services.

2.3 Current Legislation

Used fluorescent lamps intended for disposal in Alberta are currently not classified as hazardous waste. Waste Control Regulation 192/96 will allow Class 1 hazardous waste landfills to receive waste containing mercury in concentrations of less than 20 milligrams per kilogram. Waste managers are encouraged to pursue recycle options before disposal is considered. Regulations in Ontario will not permit land filling of fluorescent bulbs in concentrations of 20 bulbs or more. In Alberta, where reasonable recycling is not available for large quantities, it is suggested that used lamps be packaged with mercury absorbent material such as calcium poly-sulphide or a sulfur based absorbent. When sulfur based absorbent is used it is further recommended that the mixture be re-packed in a secondary container with alkaline surrounding the core package. Used lamps, broken and obsolete instrumentation, pre-treated as described above, are suitable for disposal at any sanitary landfill provided that the operator's permission is obtained.

3.0 FLUORESCENT LAMP RECYCLING TECHNOLOGY

Fluorescent Lamp Recyclers (FLR) in Ontario and NuLife in BC represent two of the most prominent and better established lamp recyclers in Canada. NuLife started their operation in the early nineties and FLR shortly after in 1995. These companies use a similar recycling process technology that is designed with a daily throughput capacity of 20,000 lamps. Each company undergoes annual inspections by environmental authorities and each maintains staff certification in Transportation of Dangerous goods, first aid and WHMIS.

Through each company (and their associate collectors), lamps are picked up and transported in original packaging or specially designed containers. Once transported to the recycling site, various lamp types are separated and then fed into a large crusher. During crushing, mercury vapors are contained and vacuumed through filters to eliminate airborne mercury concentration. Mercury vapor analyzers are used to monitor the workplace on an ongoing basis. Workers also wear approved respiratory and protective equipment.



This lamp recycling system is able to process 60000 lamps per day.

The crushed lamp material is separated into five waste streams:

**ALUMINUM END CAPS
AND BRASS TIPS:**

are cleaned and sent to a recycler to smelter. Mercury concentrations average approximately 3.3 mg. That is below the U.S. limit of 20 mg / kg. Canadian standards are pending.

GLASS:

is cleaned, tested and sent for recycling and re-use in non-food applications. Mercury concentrations, that adhere to the glass, are approximately 1.3 mg / kg and through Leachate testing, are well below 0.2 mg / L. (American Standard).

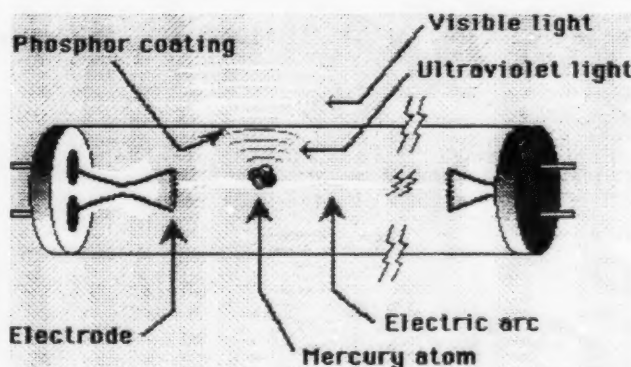
**MERCURY-RICH
PHOSPHOR POWDER:**

is put into containers and sent to approved mercury reclamation facilities where it is heated in a closed loop distillation system; the mercury is vaporized and extracted from the powders, recovered and re-used. The remaining phosphor powder is recycled and used for pigments in paint.

The mercury laden phosphor powder contains almost 75% of available mercury within each lamp. The vacuum distillation process removes more than 99% of the mercury resulting in liquid mercury with a purity of 99% (Jim Davis – Recyclights Web Site [http:// www.moea.state.mn.us/berc/mercury-lamps.cfm](http://www.moea.state.mn.us/berc/mercury-lamps.cfm)).

BAKEOLITE INSULATION:

is land filled and is free of mercury contamination.



The rapid progression of legislation in the U.S. over the past five years and pending initiatives in Canada has also resulted in the development of portable bulb recycling equipment. Portable units, like "Tub-Busters", "Bulb-Eaters" and "Lamp Crackers" eliminate the need for transporting spent bulbs to recycling centers.

Portable units are designed to eliminate exposure to phosphor dust and mercury vapor from broken light tubes through a built-in carbon absorption system and particle filters. Some models (Bulb Eater 2000) are designed to accept one light bulb at a time, which is fed into a small tube sized orifice. Others (Lamp Cracker) have a feed hopper that allows faster operation. Once crushed, the metal ends are separated from the crushed glass, mercury vapor and phosphor dust are vacuumed and filtered through specially designed filters that are either sent to recyclers who extract the elemental mercury or they are sent to approved hazardous waste disposal facilities.

The "Lamp Cracker" uses a similar ion exchange filtration process, but uses water during the crushing process. Metal cap ends are collected and sent to a metal recycler, crushed glass is used for roads and the remaining phosphor is recycled. Spent filters that collect the mercury particulates are sent to a mercury recycler.



The technologies used to recycle the component parts of lamps have similarity, based on crushing and sieving techniques. However, the selection of a lamp recycling service company should be made against established criteria.

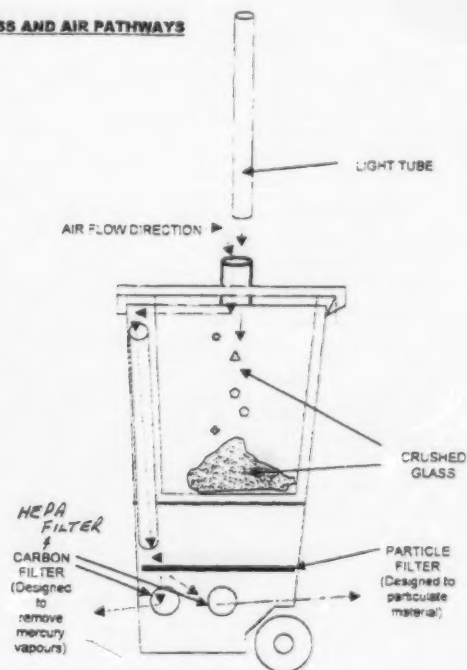
- Is the company licensed to conduct recycling activities? In Alberta, Occupational Health & Safety does not license, but is responsible to enforce safe and healthy workplace regulations. This would apply in recycling centers and as well in temporary areas where portable crushers are used.
- Will they pass Occupational Health and Safety standards particularly for concentration of mercury vapor in the work place?
- Does the company maintain and track records of movement of materials in and out of the facility.
- Are all of the activities, including lamp de-manufacturing and powder de-mercurization, conducted at the company, or are liabilities extended because additional facilities are utilized and dangerous goods (e.g. mercury laden phosphor in large quantities) must be transported.
- Are all components recycled?
- Are company employees certified?
- Can the company handle the volumes?
- Does the company provide safe storage of spent bulbs prior to recycling?

Lamp recycling technology is relatively new and based on discussions with manufacturers of equipment, it will continue to undergo improvements as the industry expands. The good news is that most recyclers, particularly those with in place "rack systems" (FLR and NuLife) have met all applicable health and safety regulations, are inspected on an ongoing basis and actually recover the mercury for re-use applications. The use of portable equipment however, is less likely to result in mercury recovery and will require operators to be certified. Such certification will apply to the use of equipment, the practices necessary to insure that operating environments are safe and in compliance with applicable regulations of Occupational Health and Safety.

Growth of the recycling industry in Alberta will depend upon program development and a sustained volume of spent lamps. At present, the collected volumes do not warrant an investment in large-scale equipment; however, the sale of portable units is increasing. For example, the sales of "Bulb Eater" (CEDA distributor) in Alberta as of 1998 is as follows:

- Amoco Canada (Calgary)
- CFB Suffield (Suffield)
- Oxford Properties (Calgary)
- Calgary Exhibition (Calgary)
- Alberta Infrastructure (Calgary)

GLASS AND AIR PATHWAYS



4.0 COLLECTION AND RECYCLING COSTS

There are two primary components that make up the cost of recycling; transportation / handling and actual processing of the lamps. In general, the greater the distance between the generator and the recycler, the greater the costs.

Based on volumes of 500 or more bulbs, the average cost to process a typical four-foot fluorescent bulb is 40¢ or 10¢ per foot. This cost applies to both portable drum type processes and larger non-portable rack systems. This cost does not apply to transportation, which again is volume sensitive. The cost per bulb to transport from Edmonton to Aldergrove, BC as per the City of Edmonton contract is approximately 8¢ per bulb (personal contact – Ken Marshall – Osram Sylvania Ltd.).

A typical shipment of 50,000 bulbs would cost in the order of \$24,000 to recycle at out-of-province facilities.

The hard cost to establish a permanent facility that recovers and recycles all components and is capable of large volume handling (similar to NuLife and FLR) is in the order of \$700,000 (\$.5 M for the recycling equipment and \$.2M for movable equipment like vans, forklifts). Assuming a five-year return on investment and a labor cost of 30¢ per bulb, a new recycler would have to handle over 3.5 million bulbs or approximately 700,000 bulbs per year. In Alberta, this represents an annual recovery of 11.6% of total volumes available. Further, it suggests that, if 25% could be achieved, it would support the development of one or maybe two permanent recycle plants for bulbs alone.

Portable crushing units can be purchased for as little as \$5,000 per unit. It has been stated (CEDA) that the operational costs of the equipment (filter replacements, etc.) runs at about 12¢ per bulb. Again, if it can be assumed that labor is 30¢ per bulb, then the overall cost per bulb would be in the order of 42¢. When this is compared to the going rate for off site recycling at 50¢ per bulb, it appears that a portable unit will result in an 8¢ per bulb saving and a subsequent five-year return on capital investment once 62,500 bulbs are crushed. Building managers that wish to build safer disposal and recycling into their programs through the purchase of portable equipment should therefore have replacement programs that exchange up to 12,000 bulbs on an annual basis. This might compare to a facility or facilities containing beyond one million square feet. It should also be mentioned however, that the wide spread use of portable disposal units is more likely to achieve a goal of safer disposal of mercury rather than true recovery and recycling since carbon filters ultimately wind up in approved hazardous waste facilities. If true recycling and recovery of mercury is the primary goal, program development must provide strong emphasis towards larger approved systems that are designed to recover the elemental mercury.

5.0 POTENTIAL PARTNERS IN THE DEVELOPMENT OF A LAMP RECYCLING INITIATIVE

The development of a voluntary lamp recycling initiative in Alberta will ideally involve:

1. **The Public Sector** and particularly managers and decision makers who are responsible for public owned buildings and infrastructure. This will include Alberta Infrastructure, Alberta Education (and its respective School Boards), Alberta Health (and its respective Health Boards), Universities and Colleges and Municipalities. Public Sector decision makers must accept the cost of recycling and budget for bulb replacement programs that reflect the need for safe recycling in contract specifications and in building management programs. Alberta Environment has a role to play in ensuring that the growth of recycling, and the choices made, are in keeping with environmental health and safety guidelines. They must also be 'first out of the shoot' in setting an example before a voluntary program is advocated to industry.
2. **The Private Sector** including:
 - ♦ Lighting Manufacturers who maintain an environmental responsibility to continue improving upon lighting products to reduce mercury content and make them longer lasting. Also, to promote recycling and safe handling of lighting products through information on packaging, sales discounts and incentives for those who recycle. Manufacturers could share in the cost of recycling by funding the cost of all public relations and promotional material.
 - ♦ Lighting contractors who should also make provisions for and encourage recycling in their services package. Also, make provisions for bulking / storing spent bulbs for shipment to approved out-of-province or in-province recyclers.
 - ♦ Building Owners Management Companies and Business Associations. These organizations that include BOMA (Building Owners and Managers Association), downtown business associations and Chambers of Commerce have reached a level of sophistication concerning environmental stewardship and can be instrumental in encouraging recycling.
 - ♦ Recyclers must advocate and demonstrate the values of recycling. They have a role to improve infrastructure and ensure that processes for recycling are safe in meeting all applicable regulations and efficient to the point where sustained volumes reflect customer discounts.

6.0 COMMUNITY / INDUSTRY CONCERNS

The development of a province-wide voluntary fluorescent bulb recycling program depends upon the ability to which certain challenges are overcome and issues dealt with.

COST TO RECYCLE: The relative cost of recycling at between 40¢ and 50¢ per bulb suggests that the overall cost associated with use of the product is approximately 33% more than the current retail cost if recycling is built in (approximately \$1.50 per four-foot bulb). This would be unacceptable to industry as a non-refundable eco fee at the point of purchase, even though those who switch to higher efficiency T8 bulbs as an example are saving 30% in energy costs. Those who are recycling now are accepting these costs as a worthy contribution to the environment and a positive component that reflects overall environmental stewardship policies.

ESTABLISHMENT OF A RECYCLING INFRASTRUCTURE: With one recycler in Edmonton who suggests that his operation has the capacity to handle all of the province's bulbs, a number of contractors who collect and ship bulbs out-of-province and some organizations that recycle their own bulbs with purchased portable equipment, it can be said that a recycling solution is in place. However, existing infrastructure has only had to handle a very small fraction of the available volumes and remains untested as a wholesale solution.

A broader recycling program that recovers 25% or better will require an improved system that is supported by larger scale recyclers who handle all recycled by-products in-house and who also receive and process mercury laden products from a host of portable equipment users.

**HEALTH AND
SAFETY:**

Bulb recycling equipment and the associated operation, at present, is available to anyone as long as they meet Occupational Health and Safety Regulations. While many users of portable equipment (as an example) can suggest that users are following procedural guidelines, the fact remains that an expanded number of portable crushers that are, or could be, in operation throughout buildings in Alberta, opens the door for expanded risk in handling concentrations of mercury. The ability to maintain a controlled environment during the recycling process is paramount. Comprehensive program development will require that the Province develop guidelines and standards that promote safe recycling alternatives.

**INDUSTRY
EDUCATION AND
AWARENESS:**

While most people understand the hazards surrounding the explosion of a fluorescent light bulb, few recognize the serious environmental concern associated with larger concentrations of bulbs and what mercury leachate can do to the environment.

Awareness and education programs will have to be developed for all sectors to enable educated decisions about establishing voluntary recycle programs. These programs should be accompanied with provincial guidelines for safe recycling.

An outline for an awareness program might include:

Print and Electronic packages which identify:

- Canada's and Alberta's mercury reduction initiatives
- The effects of mercury in the environment
- The anatomy of a typical fluorescent bulb and its mercury content
- Annual volumes
- Opportunities for recycling of bulbs – services / equipment
- The cost – a small price to pay for human life, fish and wildlife
- Where information can be obtained
- How and where to recycle spent bulbs
- Examples of lighting replacement contracts that specify recycling

7.0 AN APPROACH TO PROGRAM DEVELOPMENT IN ALBERTA

In the absence of Alberta legislation that either restricts or limits the land filling of fluorescent light bulbs, voluntary recycling by industry will likely undergo very slow growth unless certain conditions are met. Also, an eco-fee based approach is deemed unacceptable to manufacturers due to the relatively high cost of recycling compared to the retail cost of the product (recycling cost is 33% of retail price). Albertans have been conditioned to expect refunds on products that have recycled deposits built in (e.g. refundable beverage containers) and for those that have non-refundable eco-fees (e.g. milk jug recycling) the fee is such a small percentage of the retail price (less than 5%) that any resulting price increases in the product are insignificant and not at issue with the public.

The conditions that serve as pre-requisites to successful industry recycling are:

1. The adoption of recycling by the government and public sectors to:

- a) Set an example (policies and specifications in contracts).
- b) Create sufficient volumes to warrant the development of a stable recycling infrastructure.

This will require the concerted efforts of Alberta Action on Waste, the Capital Region Waste Minimization Advisory Committee, the Recycling Council of Alberta and province-wide associations that represent Alberta municipalities. It must begin with information about the cost benefit of bulb recycling and the means by which building managers can incorporate recycling into bulb replacement programs (specs).

Lighting manufacturers must be 'on board' to adopt the program and provide helpful advice and even recycling services where lighting contractors are involved with public sector building managers.

2. The creation and delivery of a public / industry awareness program and recycling promotion campaign that:

- a) Expands upon government and public sector programs.
- b) Builds on programs that already exist within the private sector.
- c) Encourages joint recycling and joint funding programs within defined geographic areas or, amongst building managers / owners that might develop joint light replacement tenders.

7.1 Recommended Program Development

- Year One:**
- Alberta Government to establish provincial target recovery of 75% to occur by 2005 and that an industry sponsored and coordinated program be developed by a committee of manufacturers and recyclers.
 - Alberta government to respond to industry program by targeting 75% recovery by March 2002 on all government and public buildings including educational institutions, health facilities and municipal buildings.
 - Alberta Government to examine and report on current programs of Alberta Infrastructure (Calgary Remand Center) vis-à-vis costs, performance and acceptability (Occupational Health & Safety) and use of portable equipment versus contracts for collection and transportation to accepted recycling centers.
 - Alberta Government to adopt policies (Alberta Infrastructure) to recycle and insure that recycling specifications are incorporated within bulb replacement contracts / tenders.
 - Alberta government to work with manufacturers to launch program for private sector and set targets of 15% recovery for this sector by March 2002.
 - Manufacturers to pay cost of advertising and program coordination.
 - Estimated annual cost of recycling bulbs for all Alberta Government buildings is \$145,000 (taken at 290,000 spent bulbs @ 50¢ per bulb). Total recovery represents 5% province-wide.
 - Publicize province's target recovery and indicate that, if targets are not met, backdrop legislation and regulations banning fluorescent bulbs from landfills may be instituted by January 1, 2005. A legislated approach may result in manufacturers funding the full cost of recycling. At 75% targeted recovery this would cost in excess of \$3M per year and would likely result in the need to raise the cost to consumers by approximately 30%.

- The Capital Region Waste Minimization Advisory Committee and Alberta Environment should develop sector workshops to explain the initiative and assist in the development of sector strategies. These workshops should be designed for both the public and private sectors and lighting manufacturers, recyclers and contractors should be included in the design and conduct of workshops that will be delivered as part of the Year Two Campaign. The role of manufacturers in funding the development of promotions material should be defined.

**Year Two
and
Year Three:**

- Continue campaign to move industry / private sector to recover 35% recovery in year two and 50% in year three.

Note: Estimated annual cost of recycling bulbs and impact to recovery is as follows:

	Volume (bulbs)	Cost	Recovery
Hospital & Health Care	330,000	\$165,000	5.6%
Colleges & Universities	460,000	\$230,000	8%
School Systems	900,000	\$450,000	16%
Totals	1.69 M	\$845,000	30%

IF ALL GOVERNMENT (not municipal offices and public works buildings) and M.U.S.H. Sector (Municipalities, Universities, Schools & Hospitals) were to achieve 100% compliance in recycling, the recovery rate province-wide would approach 30% [with the addition of municipal offices and public works buildings, the recovery might advance by an additional 120,000 bulbs and move overall recovery to 35%].

- Year Four:** - Expand industry / private bulbs recovery campaign to achieve 75% recovery from the sector.

There are an estimated 3.86 million bulbs wasted annually in the private sector. Assuming a 75% compliance over a four-year period would effectively recycle 2.9M bulbs at a cost of \$1.4M and would put overall provincial recovery at close to 80% assuming the Mush Sector has advanced to 100% recovery.

A reduction of approximately 70 kilograms of mercury would be eliminated from the waste stream and thus would not be available for release into the environment.

- Year Five through Year Ten:** - a new objective to reach 75% recovery overall should be set and focused on the household sector including expansion and/or improved awareness of programs such as the Edmonton eco-centers that now accept bulbs at no cost.

7.2 Key Program Requirements / Recommendations

Program Development (September 2000 – March 2001)

- Establish / Confirm Steering Committee
- Develop Terms of Reference to engage government and MUSH sector including:
 - information package
 - recommended purchasing / contract policies
 - confirm recyclers / recycling destinations
 - outline packaging / transportation protocol
 - conduct meetings with all government agencies and MUSH sector authorities to gain commitments to program
- Government to prepare / conduct methods to encourage safe recycling protocol including:
 - reviews and recommendations for manufacturers of portable crushing units
 - certification program for operators of portable units vis-à-vis safe operation
 - compliance information and increased education concerning Occupational Health and Safety guidelines and regulations
 - encourage Alberta based recycling infrastructure
- Develop Terms of Reference to engage industry / private sector.
 - as above with greater emphasis placed upon education, environmental stewardship and legislation avoidance
 - hire coordinator

Program Launch (March 31, 2001)

- Coordinator to launch program specific to private sector and coordinate government / MUSH sector program monitoring.
- Coordinator to administer advertising and communications.
- Coordinator to liaise between manufacturers, recyclers, collectors and generators.

March 31, 2002

- Target recovery for Government / MUSH sectors set at 75% of sector volume (1.5M bulbs).
- Target recovery for Private sector set at 15% recovery of sector volume (0.5M bulbs).

March 31, 2003

- Attempt to advance Government / MUSH sector towards 100% (2.1M bulbs).
- Target recovery for Private Sector set at 35% (1.4M bulbs).

March 31, 2004

- MUSH sector at 100% recovery
- Target recovery for Private sector set at 50% (1.9M bulbs).

March 31, 2005

- MUSH sector at 100% recovery (2.1M bulbs).
- Target recovery for Private sector set at 75% (2.9M bulbs).

**TOTAL PROVINCIAL RECOVERY TARGET BY MARCH
2005**

**4.8 m Bulbs Annually
or close to 80% recovery**

(CCME goal is 50% by 2005 and 75% by 2010)

Note: If target is reached:

- It removes potential of contaminating 144 billion litres of water or 38 billion gallons.
That is the equivalent annual consumption for over 6 million people.
- It fosters the continued development of a recycling industry with potential gross receipts of \$2.4M and most costs borne by users at the "end of life" of the product.
- It represents an environmental investment by manufacturers estimated to be just over \$50,000 per year spread over five years, a small price to pay for positive stewardship.

APPENDIX A

Note: In the table, Reservoir refers to the amount of mercury in products currently in use, Flux refers to the amount of mercury handled or replaced annually with potential for environmental releases and the Releases column refers to the amount either entering the environment or that which is adequately disposed of.

Estimated Canada Wide Releases of Mercury from Products

Product	Reservoir (kg)	Flux (kg/yr)	Releases (kg/yr, % of flux)
Sewage sludge ¹	13,100	13,100	8,200 (63%)
Dental amalgam ²	20,800	5,600	510 (9%)
Fluorescent lamps ²	8,100	4,030	150 (4%)
Thermostats ²	22,700	900	32 (4%)
Batteries ²	2,000	1,450	45 (3%)
Electric switches & gauges	17,000	7,720	32 (1%)
Hospital equipment/reagents	20,300	290	NA
Thermometers	2,700	1,840	NA

1 Releases include both incineration and land-application. Land application accounts for a total release of 4.5 tonnes.

2 Includes emissions from incineration as well as direct releases.

Source: Saskatchewan Environment & Resource Management
Canada Wide Environmental Standards

APPENDIX B

Mercury Containing Lamps – Canada-wide Standards

1. What are the Canada-wide Standards for Mercury?

The standards have two parts, which address two different aspects of the life cycle of lamps. The intent of the CWS is to reduce the content of mercury in lamps and cost-effectively reducing current releases to the environment. In the first part, the actual mercury content of lamps will decline from 1990 levels by 80%, thereby reducing emissions from manufacturing and lamp breakage (150 kg/yr). This standard applies to all mercury containing lamps, including neon tubes and low-pressure sodium lamps (streetlights) as well as compact fluorescent tubes and the more familiar four-foot tubes. The lamp industry has committed to providing reports on the average content of lamps sold in Canada so that the public can track progress.

The second part of the standard affects the “end of life” of the lamps. When broken, mercury lamps release a small amount of vapor (<1mg), but when lamps are incinerated all of the mercury is released. Also mercury in old tubes can be released in landfills either in leachate or with landfill gas – up to 750 kg / year of mercury enters Canadian landfills or incinerators from lamps. Under the CWS the target is to recycle or safely dispose of 75% of the tubes by 2010, with a focus on large scale uses such as commercial or institutional settings where recycling is economical. Homeowners may wish to ask their municipality to take old tubes back at household hazardous waste sites also.

2. What is the science on mercury?

Mercury is a naturally occurring substance and levels in soils, water and fish can vary across the country depending on the geology of the rocks and soils. Mercury is released from both natural and human activities and once in the air, can circle the globe several times before falling into lakes, streams, forests and fields. Present levels are unsafe for fish-eating wildlife, such as loons and otters, in many areas. Fish in many areas cannot be eaten safely by sport fishers or sustenance fishers. Elevated levels of fish in the diet of women of childbearing age poses a threat to the health of their newborns, which are much more sensitive than adults. Overt signs of toxicity are not apparent in Canadians, but the threat of subtle impacts is real.

3. Extent of the problem

Mercury levels in fish affect recreational fish consumption in 8 provinces and deprive First Nations of a traditional way of life. These impacts are felt across northern Canada, though most of the anthropogenic emissions are in the south. A substantial component of the threat is from mercury emitted in the United States, which is carried to Canada on local weather patterns. Other countries such as China and Russia emit mercury that is carried to Canada in the atmosphere and over the North Pole. From a national perspective, controlling Canadian emissions can help reduce the threat to both recreational fishers and First Nations, as well as impacts on wildlife, but will not eliminate them.

4. Achieving the Standards

Efforts towards achievement of these CWSs will begin with the initial actions listed in the companion document to the CWSs. Jurisdictions' detailed plans for achieving the mercury CWSs will be developed and implemented following signing of the CWSs, expected in November 2000. From an international perspective, concerted action by Canada to address its sources will be of assistance in Canadian delivery of the NAFTA-CEC Mercury Action Plan, and in obtaining necessary international efforts to reduce or eliminate mercury releases to the global pool.

Further information is available from the CCME's website at www.ccme.ca/ccme.

5. FLUORESCENT BULBS

Mr. Conrad provided a verbal update on the draft report entitled *Fluorescent Lamp Stewardship Initiative*. The draft report provided background information as well as outlining Alberta's current situation, fluorescent lamp recycling technology, collection and recycling costs, potential partners in a recycling initiative, community/industry concerns and recommended program development. This report was presented to the Fluorescent Lamp Committee at its August 29, 2000 meeting for verification and accuracy.

He noted:

- Some concerns were expressed with respect to the definition of 'recycling' versus 'recovery'.
- There was debate on how to handle and recycle, or recover the mercury and component parts of the bulbs.
- CCME targets of 75% reduction by the year 2008 in all products containing mercury.
- The proposed initiative is more aggressive than the CCME targets.
- Phase One Timeline
 - Request for Proposal by September 30, 2000
 - Selection of Consultant by October 31, 2000
 - Program implemented by March 31, 2001
 - Estimated cost for completion of MUSH Sector \$40,000
 - Funding: \$20,000 Alberta Environment, \$20,000 Manufacturers
- Phase Two Timeline
 - Request for Proposal by November 30, 2000
 - Selection of Consultant by January 30, 2001
 - Program implemented by October 31, 2001

Mr. Bell concluded noting that the manufacturers had undertaken to respond on or before September 12, 2000 to the request for funding in the amount of \$20,000, and that the a counter proposal is expected by September 14, 2000.